

PROMANAWA GEN. NOV., AN AUSTRALIAN MIOCENE PUNCIID OSTRACODE FROM HAMILTON, VICTORIA

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ABSTRACT: *Promanawa australiensis* gen. nov. et sp. nov. is described from the Miocene of Hamilton, Victoria. This is the first confirmed record of the Punciidae from Australia. The affinities, biology and biogeography of punciids are discussed. A neotype is designed for *Puncia novozealandica* Hornibrook 1949.

The Punciidae is a family of Cenozoic Ostracoda showing remarkable similarities in shape and ornament to some frilled Palaeozoic taxa (Hornibrook 1949). They are already recorded from the Miocene of Australia on the basis of a personal communication from J. W. Briggs, Jr. (cf. McKenzie 1967, p. 232). Our specimen from near Hamilton (Fig. 1), however, is the first confirmation of their occurrence on this continent. Numerous and lengthy searches of Miocene washings by one of us (K.G.M.), especially in the Balcombe Clay, from Mornington, Victoria, has failed to yield any material other than fragments.

The single valve on which our new genus and species is based is excellently preserved. We feel confident, therefore, that formal description of this unique specimen will not lead to subsequent confusion regarding the taxon.

SYSTEMATIC PALAEONTOLOGY

Family PUNCIIDAE Hornibrook 1949

Genus *Promanawa* nov.

TYPE SPECIES: *Promanawa australiensis* sp. nov.

ETYMOLOGY: *Pro*(L.)=before, and genus name *Manawa*; the species name is derived from Australia.

DIAGNOSIS: Punciid characterised by a coarse, well raised surface reticulation, an irregular dorsal margin, and the absence of lunettes on the ventral frill. Adductor muscle scars 6 in number, biserial; with about 30-40 radial (marginal) pore canals; normal pore canals few, simple and raised but not rimmed.

COMPARISON: *Promanawa* differs from *Manawa* Hornibrook 1949 most obviously by the coarse, well raised surface reticulation; in *Manawa* the reticulation is nearly flush with the surface. Further, the lunettes which characterise the ventral frill of *Manawa* do not occur in our new genus. Examination of the types of *Manawa tryphena* (Auckland Museum AM/0 84a,b) indicates that, like *Promanawa*, it has a single mandibular scar. But, unlike *Promanawa*, the main dorsal scar of *Manawa* does not lie on a prominent internal node. The radial pore canal pattern of *Promanawa* closely resembles that of *Puncia* Hornibrook 1949, the only other punciid genus yet known. However, *Puncia* has a smooth to micropunctuate and nonreticulate shell.

Unfortunately, the holotype of *Puncia novozealandica* Hornibrook 1949 was destroyed by another worker. We therefore designate as the neotype the remaining specimen from the original material, (Hornibrook 1949, pl. 50, fig. 4), a juvenile valve (Auckland Museum AM/0 85a) from, "Mestayer Stn, 7, 98 faths., off Big King" (Hornibrook 1949, p. 470).

Promanawa australiensis sp. nov.

Figs 2, 3

DESCRIPTION: Carapace broadly axehead-shaped in lateral view; calcareous; moderately inflated; coarsely reticulate, with well raised muri; each solum perforated by several small pores penetrating to the internal surface; relatively large heart-shaped mediodorsal pit housing the adductor muscle scars (which lie on the corresponding internal node); cardinal angles well defined; dorsal margin irregular; ventral margin evenly rounded; retral swing weak; slightly plenate posteriorly; frill broad and delicate, hollow between the septa, with about 40 long radial pore canals, some slightly swollen medially (the radial septa of Hornibrook (1979)). Internally left valve hinge line straight and smooth; ventral margin with prominent inner list, selvage and frill but lacking a vestibule (all pore canals extend to its inner border); normal pore canals few, scattered, simple and raised but unrimmed, occurring at muri intersections; adductor muscle scars of punciid type, numbering 6, arranged biserially (3 + 3) (cf. Ishizaki 1973) and seated on a prominent internal node; no frontal scar; a single mandibular scar present; also a large dorsal scar seated on an internal node, plus a smaller dorsal scar above and slightly in front.

DIMENSIONS OF HOLOTYPE: Left valve, adult male, NMVP74478; length—0.57 mm, height—0.31 mm. Only the holotype is known.

TYPE LOCALITY: Muddy Creek Marl, on the north bank of Grange Burn, opposite Henty's House, near Hamilton, Victoria (Fig. 1).

AGE: Early Middle Miocene (N9) (Bell & Neil 1982).

COMPARISON: The only other species of *Promanawa* is *P. konishii* (Nohara 1976) from Okinawa, originally placed in *Manawa*, which has the coarse well raised reticulation, irregular dorsal outline, numerous ventral radial pore canals that characterise our genus and also lacks

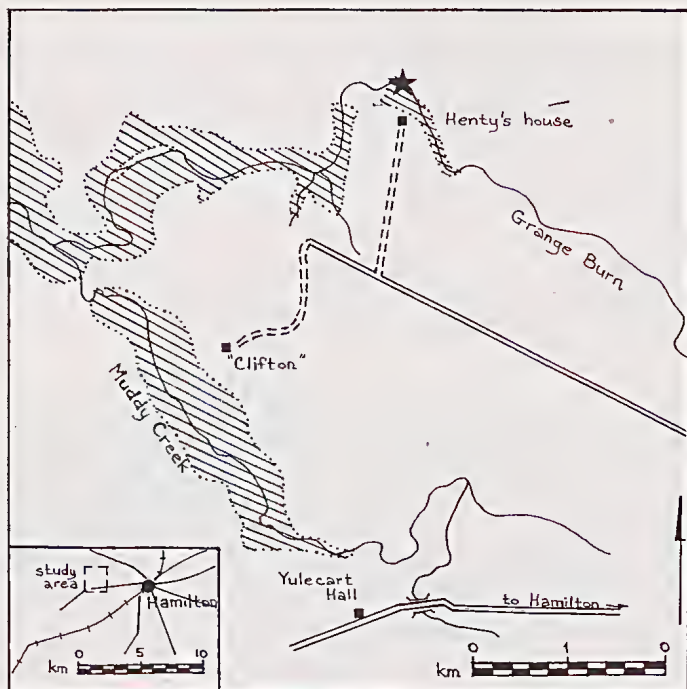


Fig. 1—Locality map of the Grange Burn and Muddy Creek area, near Hamilton, Victoria, indicating the collection site (*) and the extent of Miocene outcrop (hachured).

the ventral frill lunettes typical of *Manawa*. But the heart-shaped pit of *P. australiensis* is not clearly developed in *P. konishii* although it does have a depression in the adductor muscle scars region. *Promanawa australiensis* lacks the feeble papillae which occur on the muri of *P. konishii* and there are only about 30 radial pore canals in *P. konishii* versus about 40 in the Australian species.

DISCUSSION: Punciids are an esoteric group. Their resemblance to beyrichicope Eurychilinae was recorded by Hornibrook (1949). However, the punciid adductor muscle scar pattern, known for all species described so far (including ours), is a unique type of biserial scar. Later, Hornibrook (1963) noted correspondences between the hingement of *Manawa* and that of the kirkbyacean *Aurikirkbya* Sohn 1950. We note the further correspondence that kirkbyacean adductor muscle scars also lie on an internal node.

Kirkbyacea are now assigned to the suborder Kirkbyocopina of the order Podocopida (McKenzie, Müller & Gramm in press). This recent opinion supports comments by Ishizaki (1973) that Punciidae possibly belong in Podocopida because they have podocopid-like radial and normal pore canals and a micro-ornament (both external and internal) like that of the podocopid genus *Eucytherura*. Recently, sex dimorphism has been confirmed in *P. konishii* (Nohara & Nakasone 1982). This consists of a posterior swelling in the presumed females—interpreted as a brooding space—which resembles the type of dimorphism found in numerous podocopid genera. There is no evidence of the velar, cruminal, histial or antral types of dimorphism which characterise Beyrichicopida.

The absence of a dolon (external pouch-like cavity) in punciids separates them from the homeomorphic eurychilinid beyrichicopes but associates them with the other kirkbyacean families all of which likewise lack a dolon. Nevertheless, the prominent ventral frill of punciids is remarkably similar to the frill (velum) of some Beyrichicopida. Jaanusson (1957) discussed this feature in detail since he reasoned that it was highly important in classification of the order. Some further discussion seems warranted.

It is important to recognise that, "... the shell of an ostracod is merely a special part of the cuticle which is secreted by the epidermis as a continuous sheet which covers the whole surface of the body and limbs and lines both ends of the gut ..." (Harding 1964, p. 9). Ontogenetic studies indicate that the shell develops on either side of the mid-dorsum region as a fold. The two folds are initially united along the dorsal mid-line but split and separate at this mid-line zone at a later stage in embryonic development. Subsequently, each valve consists of an inner and outer lamella. The ventral border between these lamellae is the distal shell margin or flange. Calcification begins first with secretion from epidermal cells of the outer lamella; and secondarily from epidermal cells of the ventral inner lamella, proceeding from the flange inwards. As this secondary calcification continues, the marginal sensory bristles need long canals through the fused lamellae to maintain their contact with the external environment (Hartmann in Harding 1964, p. 29, 30). Detailed SEM and TEM study of podocopid pores by Okada (1982) has confirmed this functional interpretation of the marginal (radial) canals.

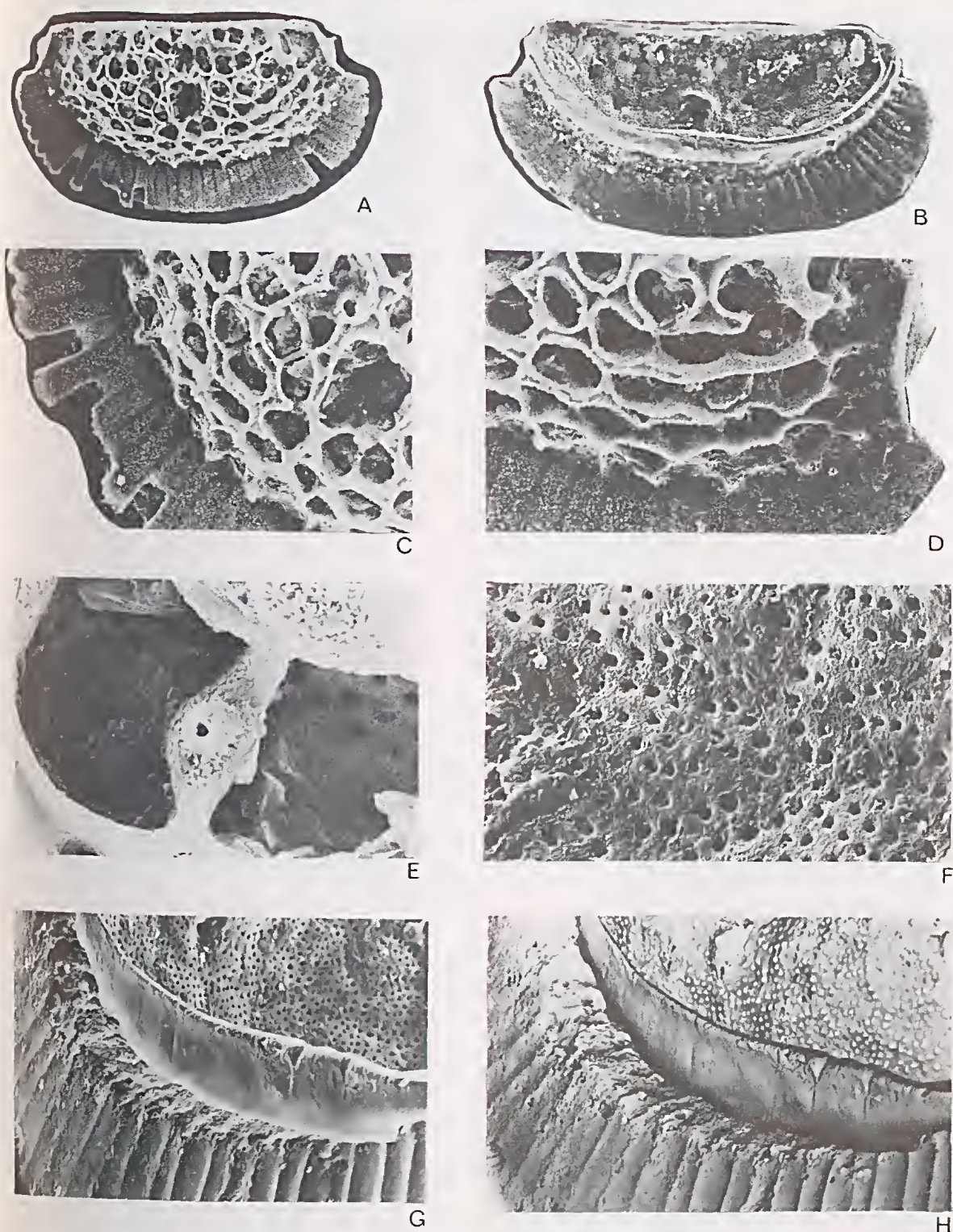
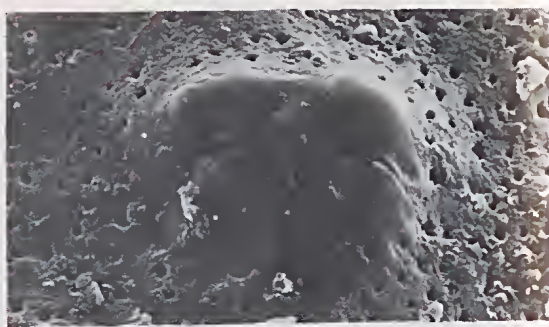


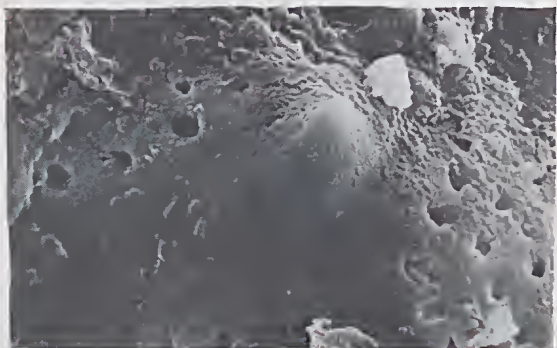
Fig. 2—*Promanawa australiensis* gen. et sp. nov. Holotype, mature male left valve (LV), NMVP74478. A, external view, $\times 154$. B, internal view, $\times 189$. C, anteroventral detail, $\times 350$. D, posteromedial detail, $\times 430$. E, detail of unrimmed and raised normal pore canal, $\times 1860$. F, detail micropunctate internal surface, $\times 1690$. G, detail posteroventral internal surface, $\times 540$. H, same as G (negative image effect created by altering the black level setting on the SEM), $\times 540$.



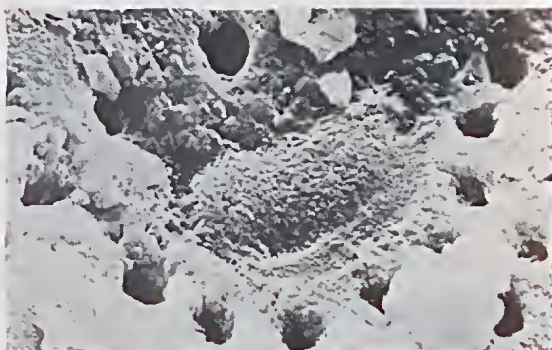
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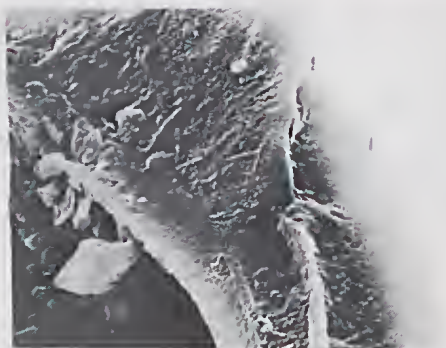
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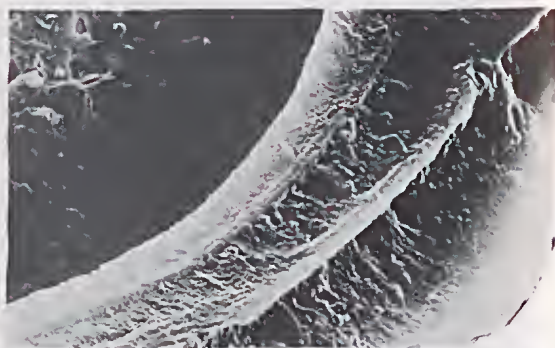
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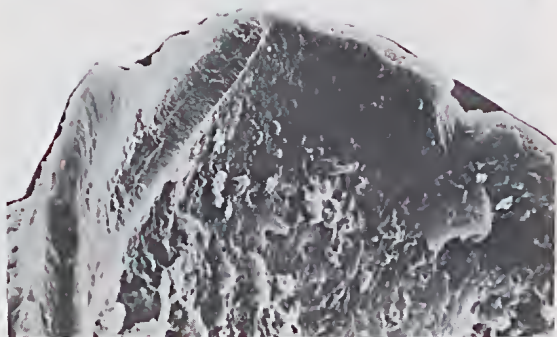
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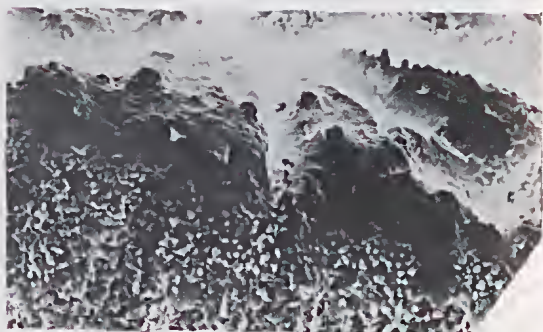
E



F



G



H

The calcification of the frill clearly differs from both the primary calcification of the outer lamella and the secondarily calcified inner lamellae (Fig. 2A, B). Punciid ontogeny is virtually unknown but we suggest that the frill does not appear until relatively late perhaps not until development of the anlagen of reproductive characters in the soft anatomy.

Considered in this way, the punciid frill (velum) is a homologue of the zone of concrescence in podocopid Ostracoda and the radial 'septa' are homologues of radial pore canals. Figure 2C indicates that between these radial canals the frill is hollow. The canals extend to the edge of the selvage (Fig. 2F, G) (i.e., there are no vestibules in punciid inner lamellae). The punciid selvage is at least an analogue of the velar ridge (Jaanusson 1957) in Beyrichiocopida and might well be homologous with it.

The adductor muscle scar cluster is located slightly posterior of the midlength (Fig. 2A). This implies that the antennules and antennae of punciids are relatively elongate. The mandibular scar indicates a mandibular coxale of transverse biting type and supports a hypothesis that punciids feed benthically since mandibular scars do not occur in pelagic taxa. The more prominent dorsal muscle scar is probably the attachment site for an extrinsic muscle to the ventral rim of the antenna and the smaller dorsal muscle scar near it probably represents the attachment site of an extrinsic muscle to the dorsal rim of the antenna (Smith 1965). The size of the larger scar and its position on a well defined internal node indicate that the punciid antenna is powerful and better adapted for crawling than swimming.

Since the ventral shell margin is convex, a feature usually restricted to swimmers (e.g., Myodocopida), punciids may well be capable of some swimming bursts. However, they are unlikely to be pelagic, because the distribution of pelagic taxa is not as limited as that of punciids. Punciids probably live benthically, as other podocopids do, even such good swimmers as the cypridacean Pontocyprididae. A more likely functional interpretation of the convex ventral margin in punciids is that, along with their straight hinge line, it favours dorsal/dorsal or posterodorsal mating. The frill could also impart some stability to punciid shells thus adapting them for a benthic existence (Kesling 1969, p. 308, 309).

The distribution of Punciidae is restricted to the western Pacific, ranging from Japan to Australasia. The oldest occurrence is from the Early Miocene of New Zealand, Hornibrook (1963) having described *Puncia goodwoodensis* from the lower Goodwood Beds near Dunedin, South Island. The next oldest record is ours,

from the early Middle Miocene of Australia. The Okinawa material comes from the tuffaceous Pliocene Shinzato Formation and the Pleistocene Chinen Sand, a total of about 40 specimens having been picked thus far from washings representing 5 localities (Nohara & Nakasone 1982). Recently, new finds of Pleistocene punciids have been made in Japan by Yajima and in New Zealand by Briggs (P. De Deckker, personal communication, February 1983). Living species are confined to the warm offshore waters of New Zealand's northern Aupourian marine province where they were collected at a depth of about 175 m (Hornibrook 1949).

With such a distribution pattern, and even though the records are few, Punciidae may be considered a useful group for dating the impingement of Australasia against Indonesia according to the principles outlined by McKenzie (1978). On the punciid evidence, this event probably postdated the early Middle Miocene and antedated the mid-Pliocene, a schedule established from numerous other ostracodes (McKenzie 1978).

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Fig. 3—*Promanawa australiensis* gen. et sp. nov. Holotype, mature male left valve (LV), NMVP74478, internal views (except H). A, detail of muscle scars including central adductors, mandibular, plus 2 dorsal scars, $\times 720$. B, detail of central adductor scars, situated on internal node, $\times 1250$. C, detail of main dorsal scar, sited on internal node, plus a less prominent dorsal scar above and slightly to the right, $\times 2360$. D, detail of mandibular scar, $\times 4100$. E, detail of anterodorsal hinge accommodation groove (finely crenulate on either margin), $\times 1790$. F, continuation of E more ventrally, developing into inner list and selvage, $\times 2360$. G, detail posterodorsal terminus of hinge, $\times 1220$. H, posteroventral detail external view, showing emergence points of some pores along the inner margin of the frill, $\times 1500$.

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